Energy Storage

An Essential Resource for California's Smart Grid

The California Energy Storage Alliance (CESA)

Janice Lin | CESA Director and Managing Partner of StrateGen Consulting

CPUC Smart Grid Workshop: Transmission and Storage

June 26, 2009

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Storage is a necessary component of the smart grid

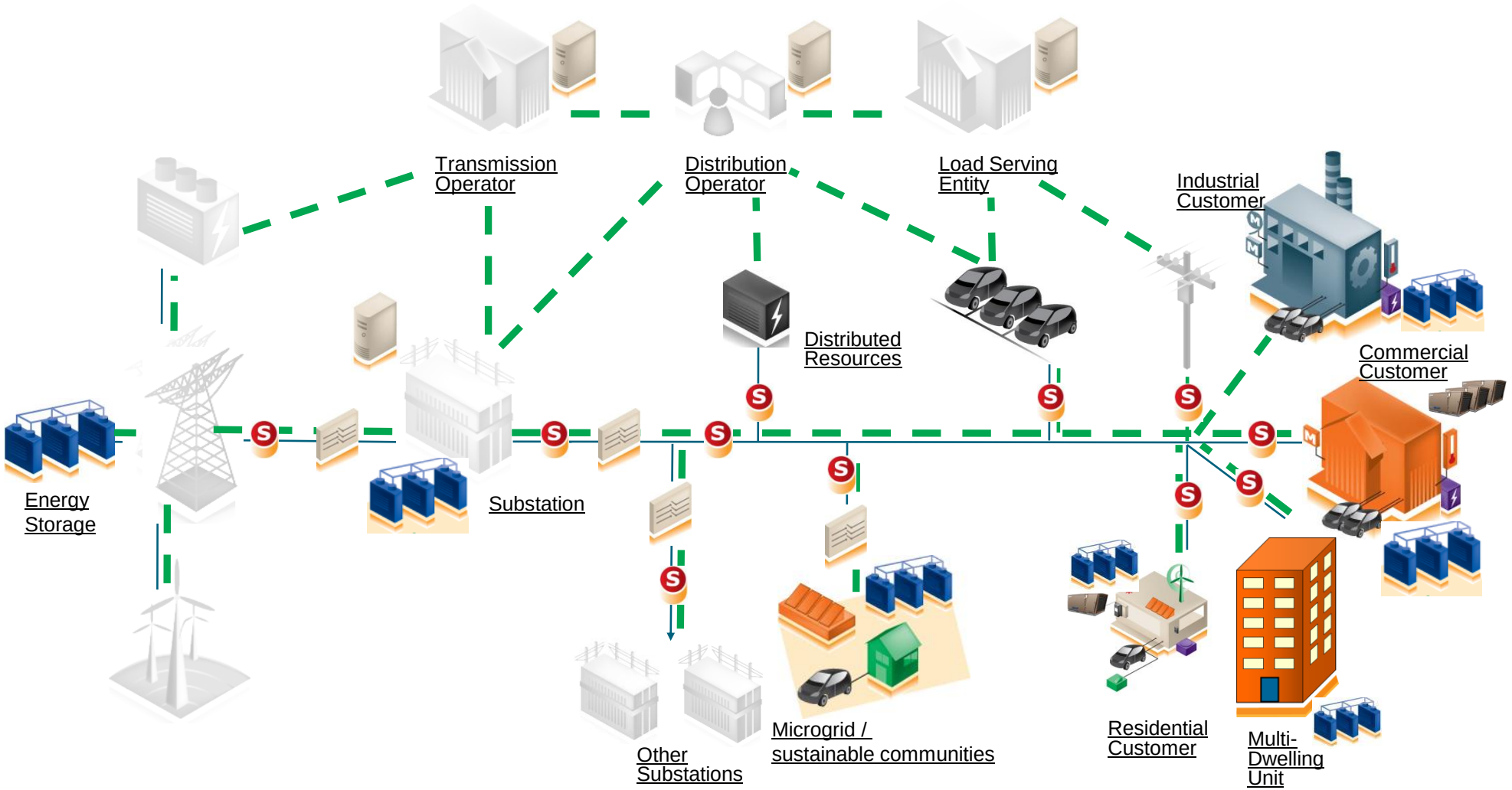

Diagram courtesy of PG&E

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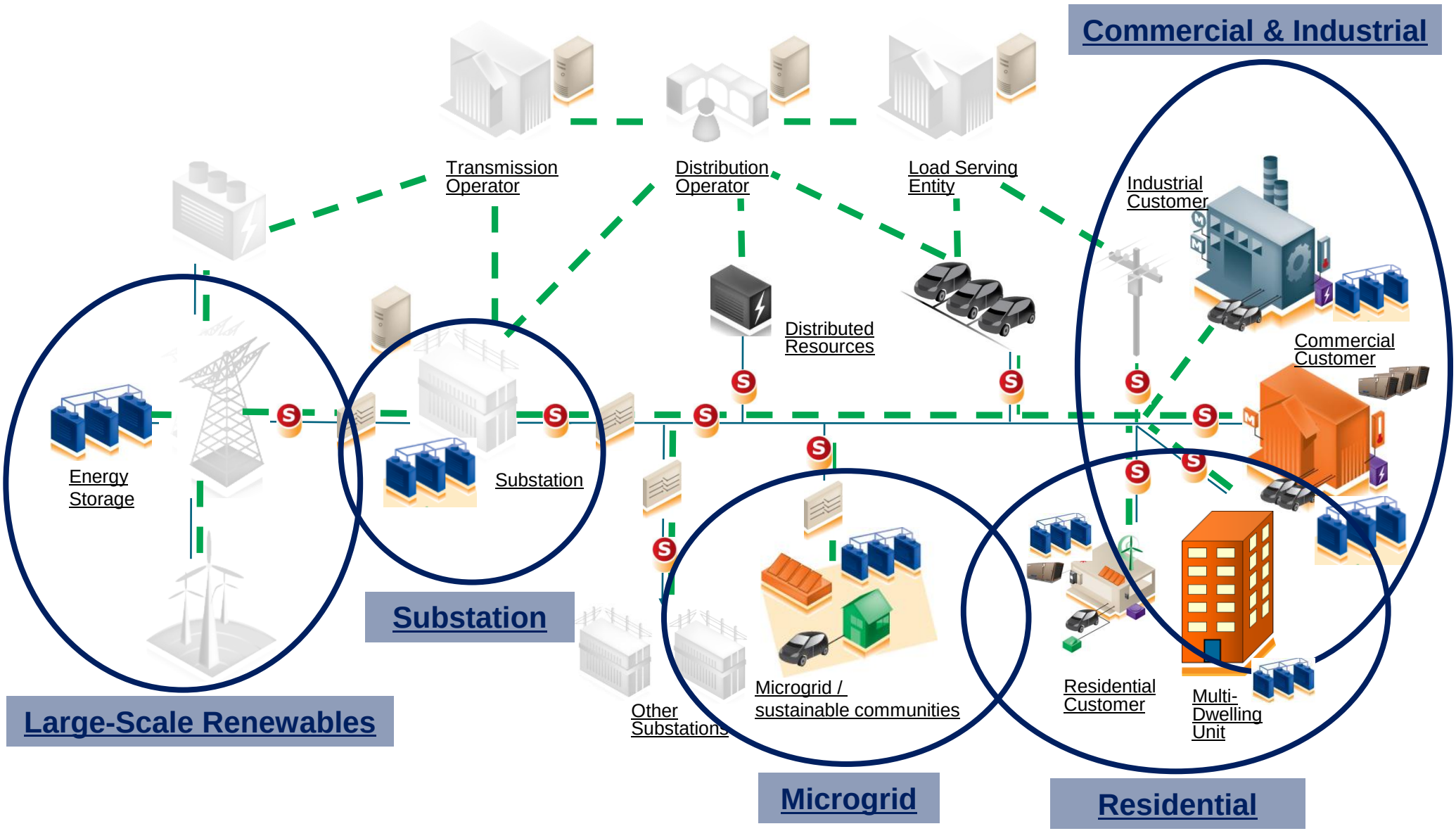

Diagram courtesy of PG&E

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Storage enables capture of multiple value streams

Storage will facilitate many energy policy initiatives: Demand Response, RPS, Smart Grid, Resource Adequacy

Customer	+	Utility	+	System Operator	+	Society
• Reduced energy and demand costs • Emergency back up • Demand response • Improved reliability		• Load leveling • T&D relief / deferral • Improved power quality • Reduce peak gen. and spinning reserve needs		• Ancillary services • Grid integration • Improved grid reliability & security		• More renewables • Fewer emissions • Healthier climate • More jobs

Furthermore…

» Storage can be deployed under many business models (utility owned, customer owned, third party owned)

» 'Dispatchable renewables' can be realized with energy storage

» Storage is a key requirement for high penetration of renewables, especially on microgrids

Storage systems are commercially ready and can be deployed quickly

Phase I

Start with smaller customer sited storage, linked with AMI

Utility owned storage demonstrations – capital deferral

20 MW ancillary services storage demonstrations with CA ISO

2009-2011

Goal: 25-100 MW deployed

Phase II

Couple with distributed wholesale (higher value FiT or PPA)

Demonstrate storage as key enabler of sustainable microgrids

2012-2015

100-500 MW deployed

Phase III

Demonstrate large scale transmission level storage (50-100MW/site)

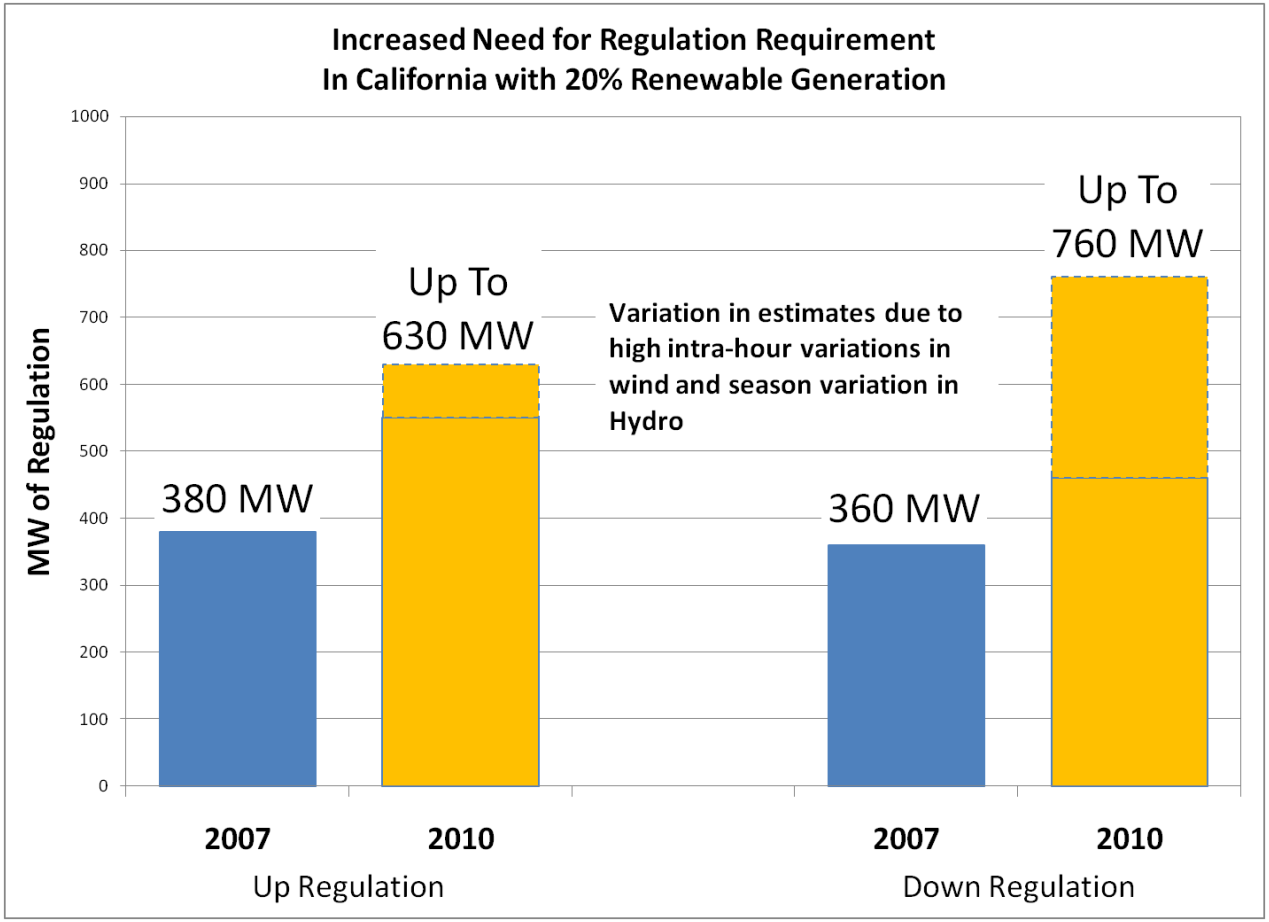
Accelerate distributed storage deployment for multiple applications

2015-2020

1,500 MW+ deployed

CA's RPS implementation will increase the need for regulation and ramping

- **Increased wind penetration creates need for greater regulation capacity and faster regulation ramping capability**
- **Nov '07 CAISO report identifies significant additional regulation requirements with 20% renewables (about 10% wind penetration)**



Ancillary services can be provided today at 20 MW scale, and from systems as small as 1 MW on the customer side of the meter

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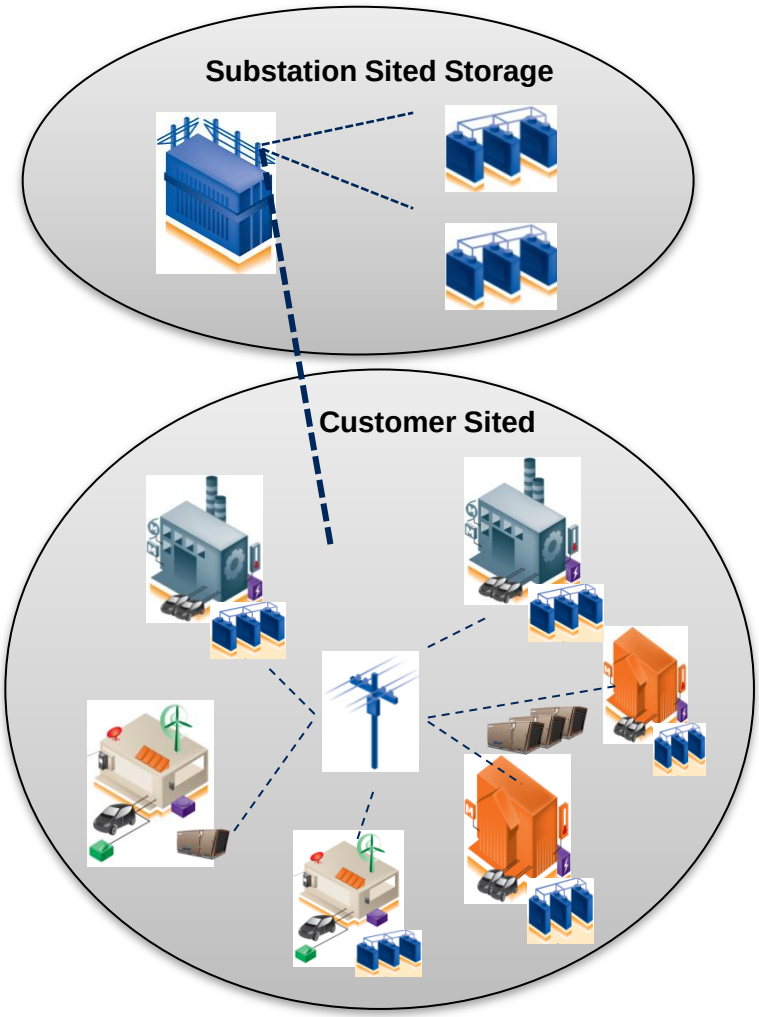
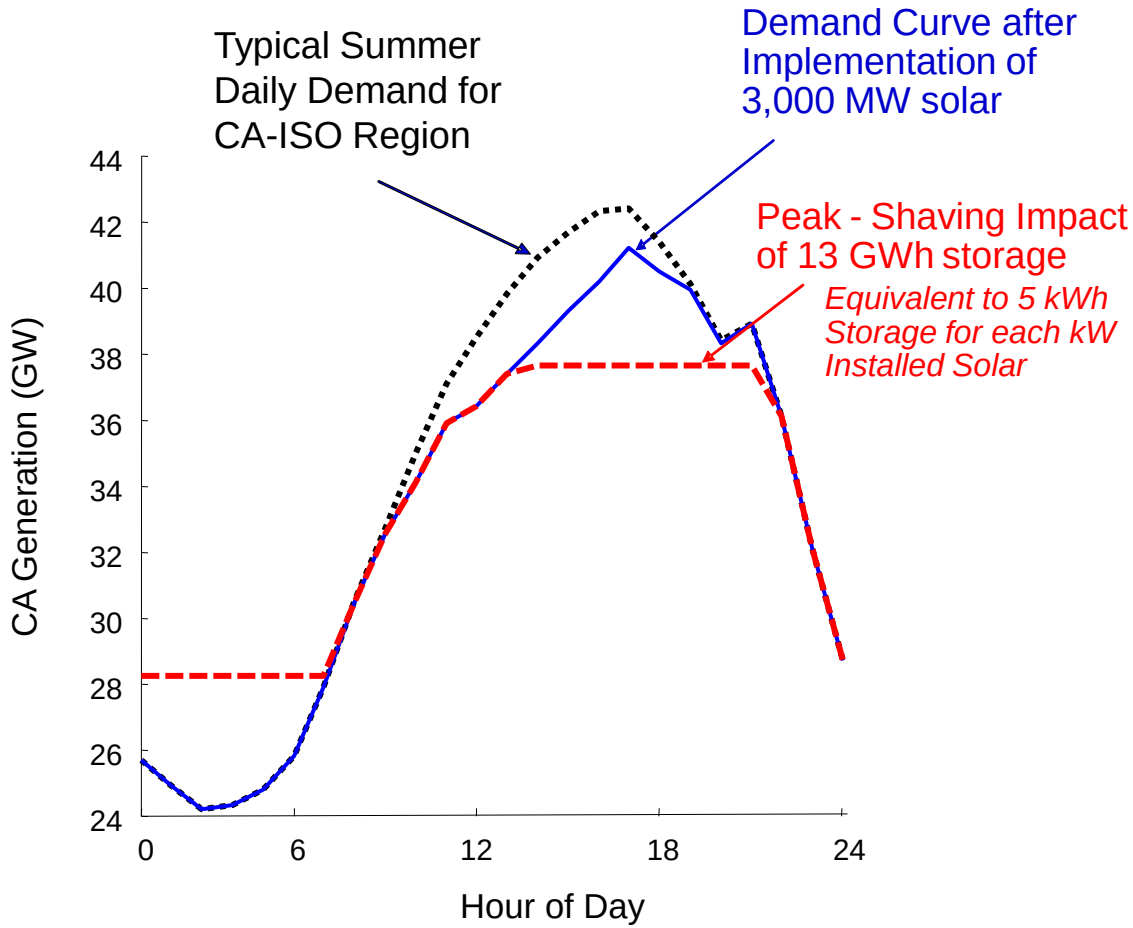
Distributed Applications Are Utility-Scale

Small distributed systems can have a grid-scale impact





Source: EPRI

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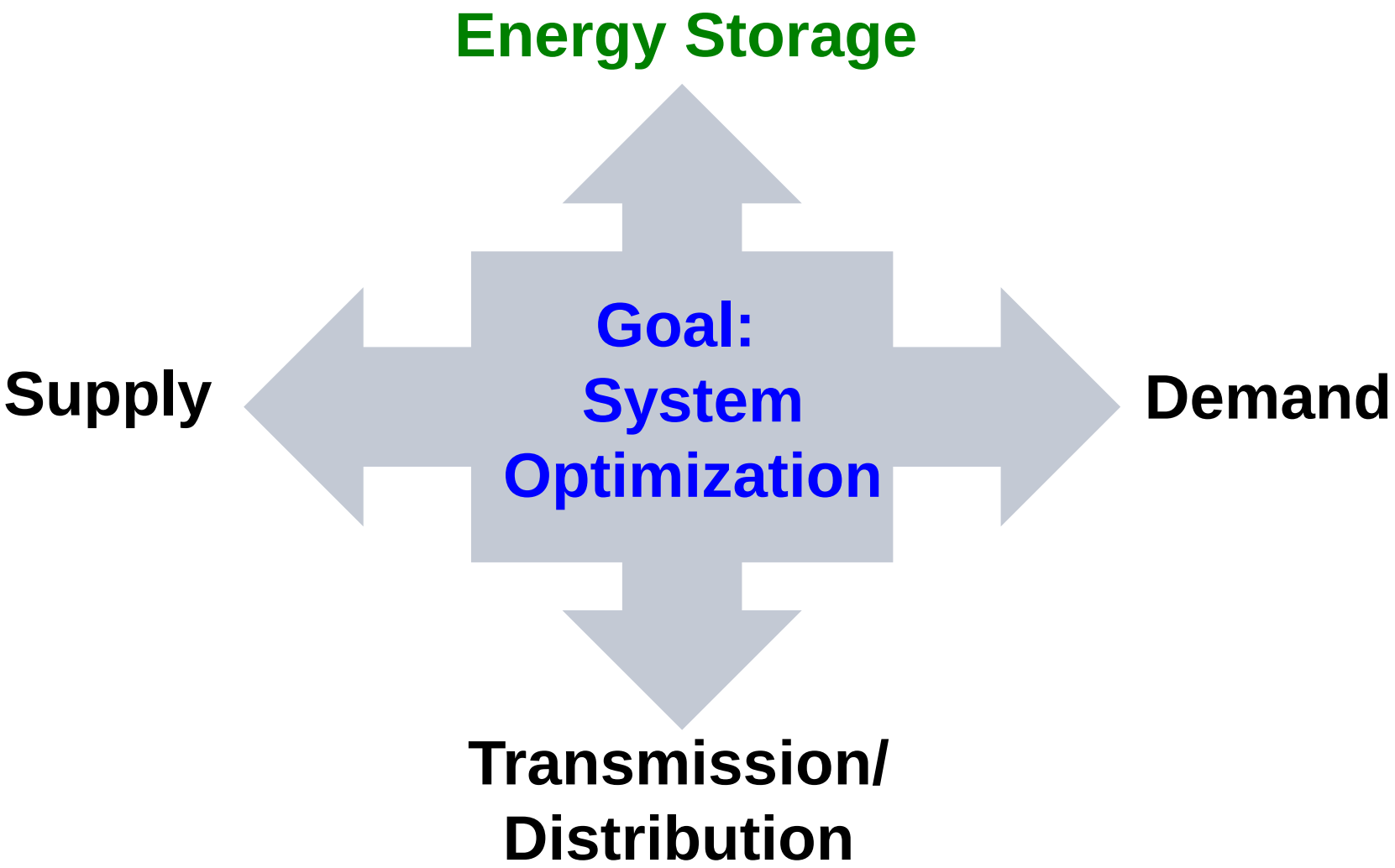
Government intervention is needed to overcome current barriers

Current Barriers

- **Cost / Economics**
  - Many storage technologies have not achieved scale economies
  - Analyzing impact of storage, especially coupled with renewables, is very challenging
- **Technology**
  - Many solutions, all with tradeoffs
  - First demonstrations of new applications are difficult to implement
- **Regulatory / Policy**
  - Difficult to aggregate complete value streams provided by storage
  - Perception that storage is just a 'utility solution'
  - Tariff design that does not reflect true cost of producing and delivering power on peak
  - Incomplete CA ISO implementation of FERC Order 890/719 energy storage tariff for regulation
  - Unclear net metering rules for storage + renewables projects
  - Integration of storage into all aspects of policy making

Energy storage is deserving of its own asset class category and immediate energy policy focus



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Enabling storage will enable the smart grid!

Additional incentives & RD&D are needed:

- **Incentives**
  - ‘Fully implement' SGIP (need incentives for standalone and solar apps)
  - Allow an increased rate of return for utility owned storage, similar to renewables treatment
  - State supported alternative energy financing for storage
  - Tax incentives comparable to solar and wind (ITC and MACRS)

- **RD&D funding**
  - Accelerate deployment of ‘integrated’ demonstration projects under various business models
  - Leverage federal ARRA funding for California storage related activity
  - Create CA-based Energy Storage Center of Excellence to provide technical and policy leadership

Enabling storage will enable the smart grid!

CESA policy recommendations:

- **Goal: leverage storage under multiple ownership models to help enable the Smart Grid, GHG reduction, EE, DR and the RPS**

  - Include storage in DG, DR, EE cost benefit methodologies
  - Increase FiT cap and price for renewables firmed with storage
  - Require storage as part of current LT procurement process
  - Require storage eligibility for next Permanent Load Shifting RFP
  - Explore retail tariff design that encourages load shifting
  - Implement energy storage tariff for regulation (comply with FERC order 890 and 719)
  - Implement a 3:1 RPS multiplier for renewable energy firmed with storage to deliver on peak
  - Consider a peak reduction standard for state energy purchases
  - Clarify net metering rules for renewable energy projects with storage

End of Presentation

The California Energy Storage Alliance (CESA)

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The California Energy Storage Alliance (CESA)

Our Goal: ***Expand the role of storage technology to promote the growth of renewable energy and create a more stable, secure electric system***

- CA-focused advocacy group representing energy storage stakeholders
- Focus on storage coupled with renewable energy integrated into the smart grid
- Immediate work is on distributed applications of energy storage
- Current priorities/activities include:
  - CPUC
    - SGIP AES implementation
    - DG (DER) cost benefit methodology
    - Smart Grid OIR
  - Storage legislation: AB 44, AB 1536

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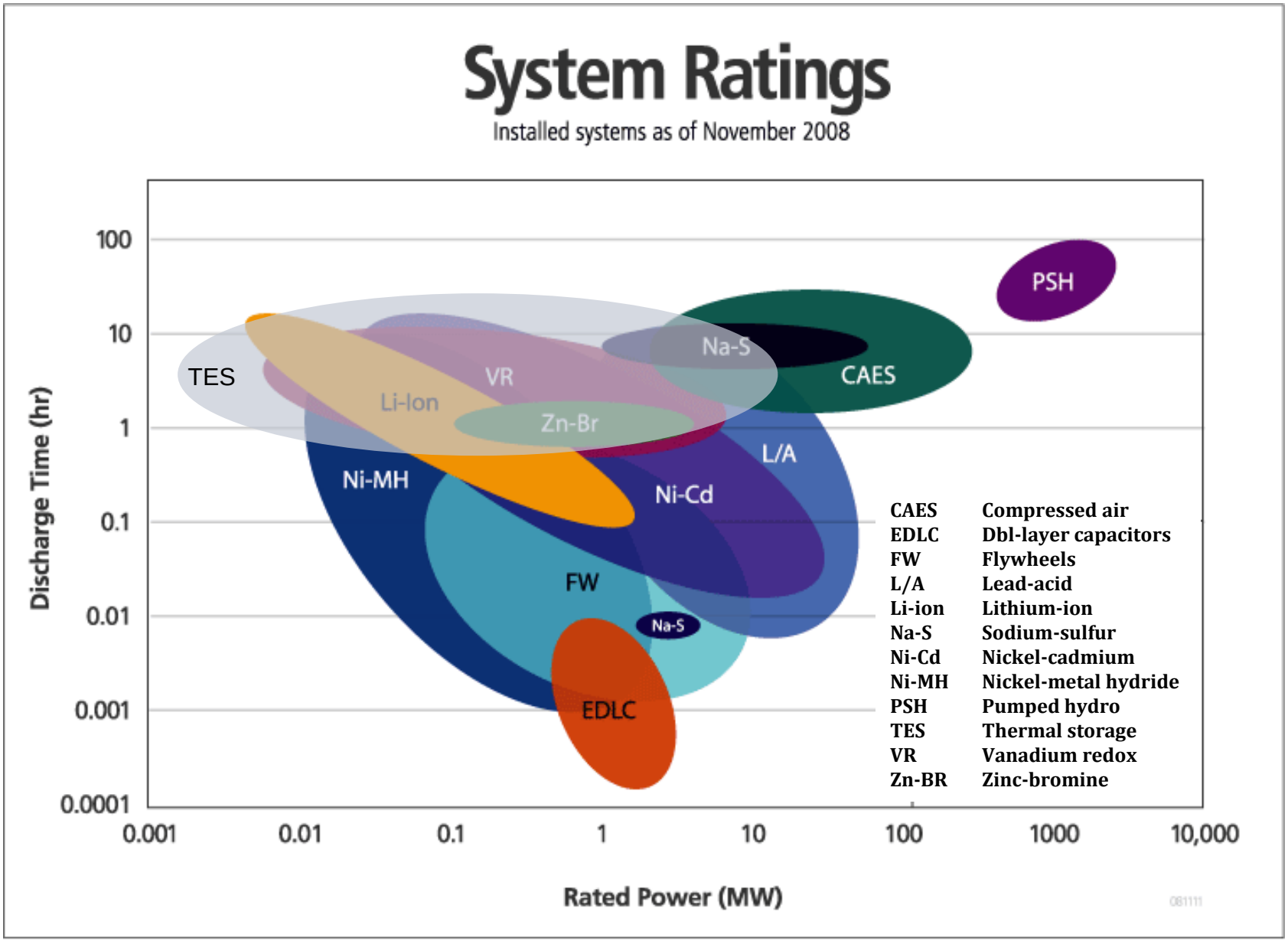
There are many commercially available energy storage technologies today



Source: Electricity Storage Association

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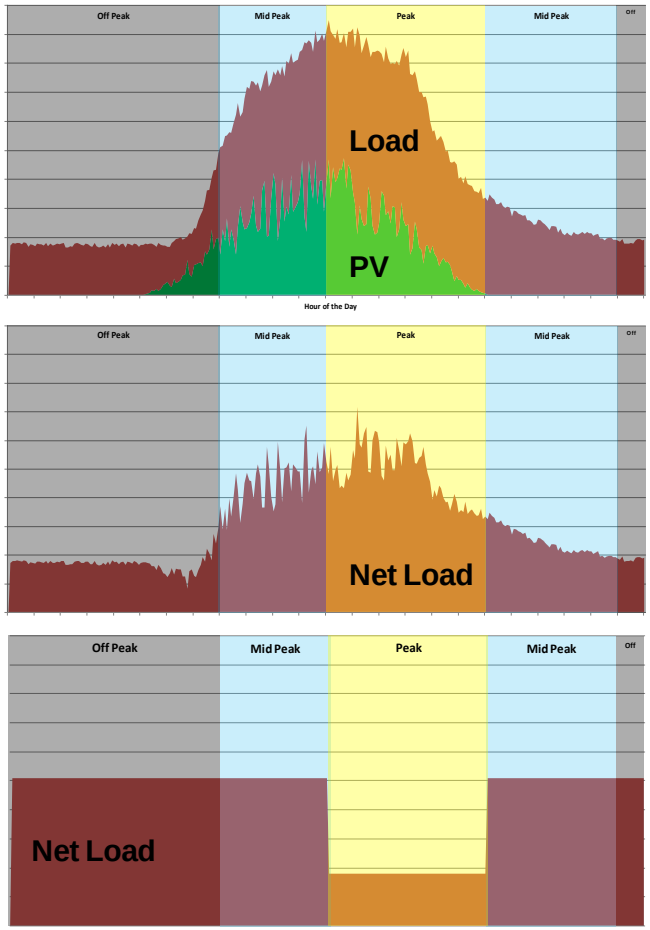
Storage effectively integrates renewables into the smart grid (solar example)

Distributed Solar + Storage

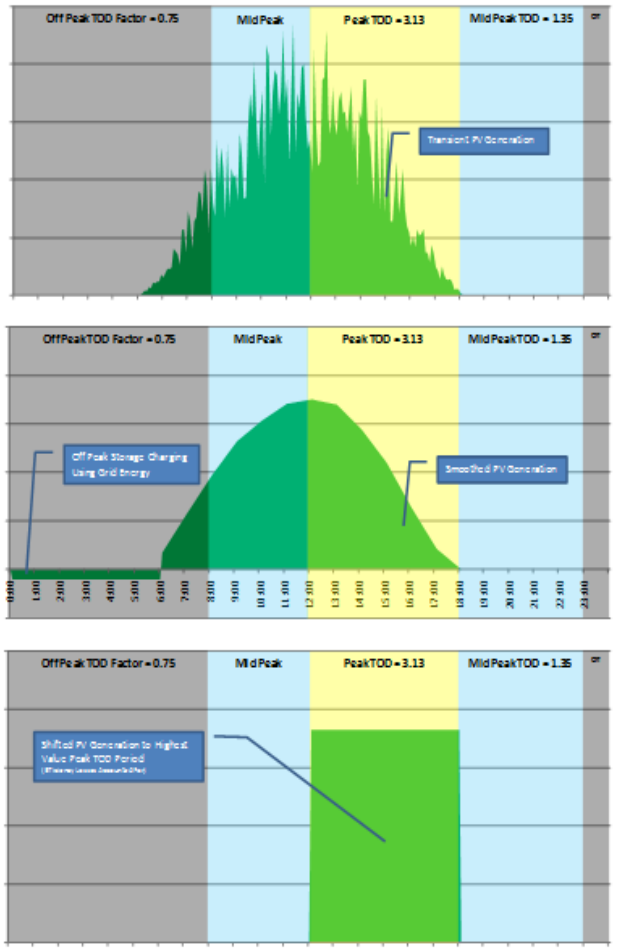


Load & Solar Generation

Net Load is Still Coincident with Peak Demand Charges

Storage to Shift Net Peak Load to Off Peak Periods

Wholesale Solar + Storage



Solar Generation

Output Firming (Smoothing) with the Assistance of Storage

Storage to Shift Generation to Peak Periods

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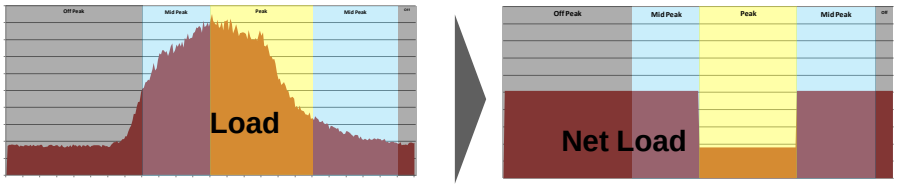
Storage + distributed renewables: 1 + 1 = 3

Integration delivers a better value proposition than either technology alone. Solar example:

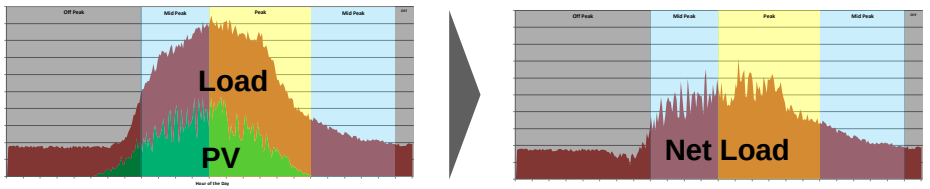
Storage* – Standalone (IRR 4.8%)

- Charge at night and discharge during peak to reduce demand charges



Solar – Standalone (IRR = 4.1%)

- Generate energy during day to offset load and avoid energy costs



Solar *with* Storage

Storage + Solar (IRR = 5.9%; 6.8% with SGIP & ITC on both)

- ✓ Obtain full demand savings on storage + avoided energy costs of solar
- ✓ Obtain synergies thru more efficient charging of battery with solar
- ✓ Reduce total system costs by sharing inverters, equipment
- ✓ Potential to leverage FITC for both technologies
- ✓ Potential to provide emergency back up capabilities

*Assumptions: Storage assumptions same as previous slide; PV assumptions – turn-key all equity purchase, SCE TOU 8, $5/Wp CAPEX, 30% FITC, $0.15/kWh CSI PBI

Assumptions: 100kW, 6h, 65% AC roundtrip efficiency battery; 350kWp PV & turbine systems; $475kWh ($2,850/kW) battery CAPEX, $0.075/kWh discharged & $6/kW fixed battery OPEX; SCE TOU-8 tariff, California high school load profile; $2/W SGIP incentive

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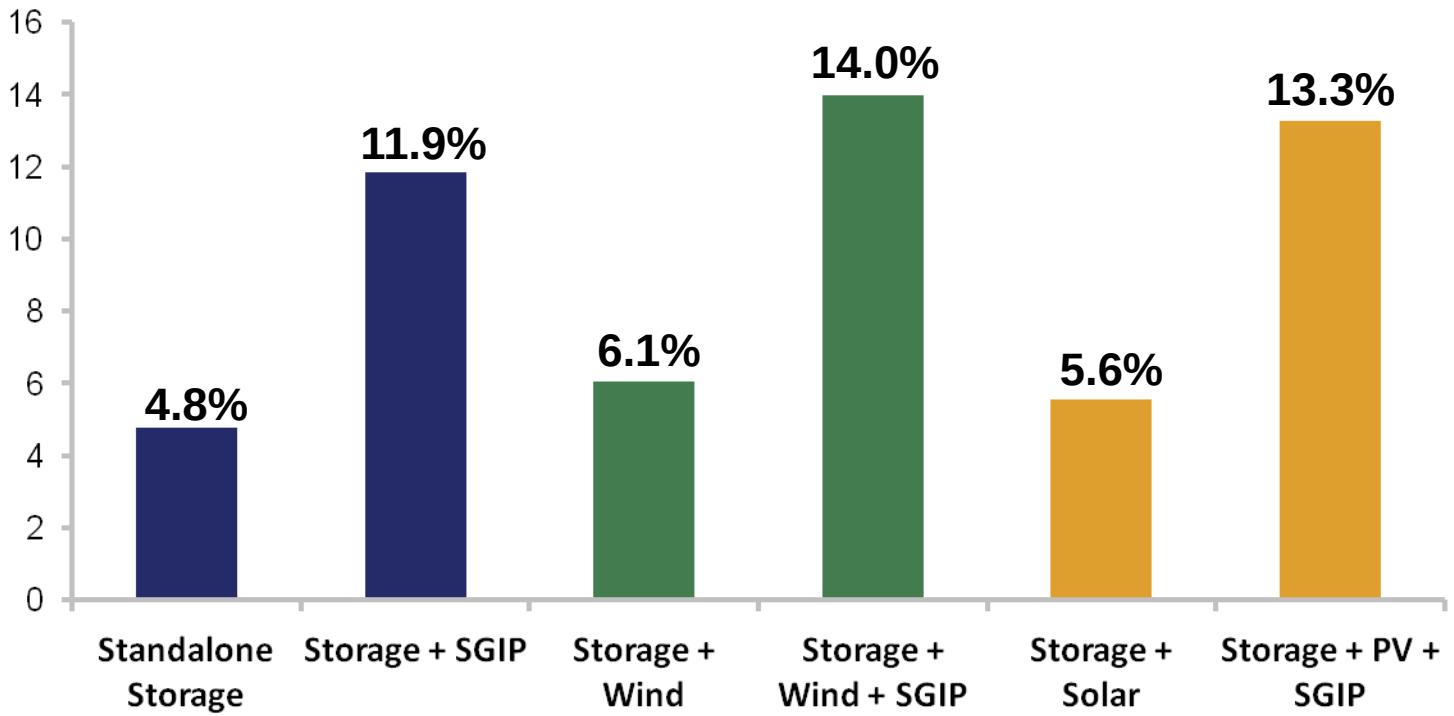
Thank you for your leadership with the SGIP!

The SGIP will have a significant impact on end-customer returns, accelerating deployment of grid connected storage

Incremental IRR of Battery for the End Customer – Illustrative Battery Example



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Benefits of Storage – Renewable Integration

"Enabling technologies such as fuel switching in 'smart' appliances, dispatch-able load from plug-in hybrid or other electric vehicles, or stationary energy storage would be required to enable very high levels of PV contribution (>20%) to the electric power system".

- NREL Denholm & Margolis, April 2006

"When PV penetration reaches sufficiently high levels (e.g., 5 to 20% of total generation), the intermittent nature of PV can begin to have noticeable, negative effects on the entire grid" [requiring storage]

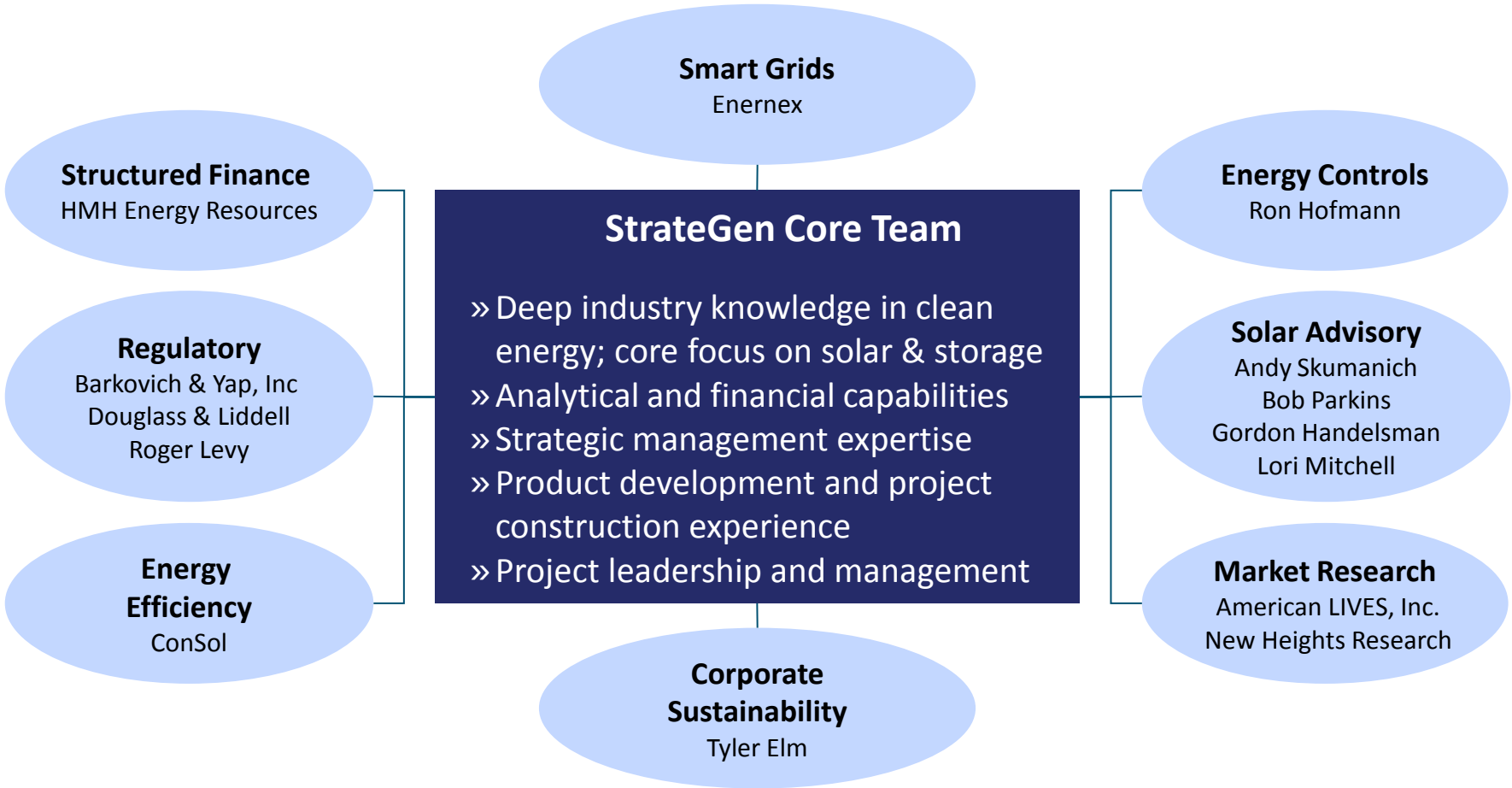
- US DOE, SEGIS-ES, July 2008

"Storage will need to be part of our portfolio if going to 15 to 20 percent wind at a national level, otherwise it won't be efficient at a lower level and it won't get us where we want to go environmentally"

- Electric Power Research Institute, March 2009

StrateGen Overview: Our Firm

StrateGen helps businesses create sustainable value through clean energy solutions



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